

## Claims

1. A fuel cell comprising a porous electrically-conductive material as a substrate, a protonically-conductive membrane formed on the porous electrically-conductive material made of a mesoporous thin film comprising as a main component a crosslinked structure having a metal-oxygen skeleton having an acid group connected to at least a part thereof and having pores periodically aligned therein and a porous electrically-conductive material layer formed on the protonically-conductive membrane.

2. The fuel cell as defined in Claim 1, wherein the crosslinked structure is formed by a silicon-oxygen bond.

3. The fuel cell as defined in Claim 1 or 2, wherein the mesoporous thin film has a thickness of 10  $\mu\text{m}$  or less.

4. The fuel cell as defined in any one of Claims 1 to 3, wherein the porous electrically-conductive material is a porous silicon layer formed by the anodization of silicon.

5. A method for producing a fuel cell comprising:

A step of forming a substrate at least the surface of which is a porous electrically-conductive material;

A step of forming a protonically-conductive membrane made of a mesoporous thin film comprising as a main component a crosslinked structure having a metal-oxygen skeleton having an acid group connected to at least a part thereof and having pores periodically aligned therein on the porous electrically-conductive material; and

A step of forming a porous electrically-conductive material layer on the protonically-conductive membrane.

6. The method for producing a fuel cell as defined in Claim 5, wherein the step of forming the substrate involves a step of anodizing the surface of a silicon substrate to form a porous silicon layer thereon.

7. The method for producing a fuel cell as defined in Claim 6, wherein the anodization step is preceded by a step of selectively etching the fuel cell forming region to a desired thickness.

8. The method for producing a fuel cell as defined in Claim 6, wherein the step of forming a porous silicon layer is followed by a step of etching the silicon substrate on the back side thereof so that the porous silicon layer is reached to form a thin film.